

## PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference INT1138/MAJR	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/ZA2004/000131	International filing date (day/month/year) 28.10.2004	Priority date (day/month/year) 29.10.2003	
International Patent Classification (IPC) or national classification and IPC E21D21/00			
Applicant GRINAKER-LTA LIMITED et al.			
<p>1. This report is the International preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> <i>(sent to the applicant and to the International Bureau)</i> a total of 5 sheets, as follows:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</li> <li><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the International application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</li> </ul> <p>b. <input type="checkbox"/> <i>(sent to the International Bureau only)</i> a total of (Indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Box No. I Basis of the opinion</li> <li><input type="checkbox"/> Box No. II Priority</li> <li><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li><input type="checkbox"/> Box No. IV Lack of unity of invention</li> <li><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li><input type="checkbox"/> Box No. VI Certain documents cited</li> <li><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</li> <li><input checked="" type="checkbox"/> Box No. VIII Certain observations on the International application</li> </ul>			
Date of submission of the demand 03.06.2005	Date of completion of this report 16.01.2006		
Name and mailing address of the International preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Garrido Garcia, M Telephone No. +31 70 340-4468 		

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/ZA2004/000131

**Box No. I Basis of the report**

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
    - international search (under Rules 12.3 and 23.1(b))
    - publication of the international application (under Rule 12.4)
    - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the elements\* of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

**Description, Pages**

2-4, 6-9	as originally filed
1, 5	filed with telefax on 03.06.2005

**Claims, Numbers**

1-13	filed with telefax on 03.06.2005
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**Drawings, Sheets**

1/5-5/5	as originally filed
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a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3.  The amendments have resulted in the cancellation of:
  - the description, pages
  - the claims, Nos.
  - the drawings, sheets/figs
  - the sequence listing (*specify*):
  - any table(s) related to sequence listing (*specify*):

4.  This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

the description, pages  
 the claims, Nos.  
 the drawings, sheets/figs  
 the sequence listing (*specify*):  
 any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/ZA2004/000131

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-13
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

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**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/ZA2004/000131

Reference is made to the following documents:

D1: CH 564654

D2: US 4 655 644

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Notwithstanding the conciseness objections raised under point Re Item VIII below, a reasoning with regard to the novelty and inventiveness of claim 1 will be provided.

1.1 Document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document) a rock bolt which includes a tubular section (3) which is expansible to effect a first anchoring action and an expansion unit (10) which is expansible to effect a second anchoring action and which is connected to the tubular section (3).

1.2 The subject-matter of claim 1 differs from this known rock bolt in that the expansion unit includes a wedge member (44), and a plurality of shells (46) which are movable by the wedge member to effect the second anchoring action.

1.3 The expansion unit of D1 is an expansible tubular instead, and therefore the subject-matter of claim 1 is new (Article 33(2) PCT).

1.4 The problem to be solved by the present invention may be regarded as increasing the effectiveness of the anchor.

1.5 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: D1 discloses a friction anchor, whose anchoring force is proportional to the frictional force generated. In the anchor according to claim 1, this type of anchoring is combined with a second anchoring of the wedge/shells type. This second type of anchoring is also known from the prior art (see document D2), but no hint was found toward a bolt as the one of claim 1, which reduces the amount of frictional force that needs to be generated by

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.  
**PCT/ZA2004/000131**

supplementing the first anchoring action with the second anchoring action. Claim 1 is thus considered to be inventive (Article 33(3) PCT).

2. Claims 2-10 are dependent on claim 1 and as such also meets the requirements of the PCT with respect to novelty and inventive step.

**Re Item VII**

**Certain defects in the international application**

3. The document D1 reflecting the prior art is cited on amended page 1, in accordance with Rule 5.1(a)(ii) PCT. However, it is erroneously stated that "a shank which is connected to the anchors is recoverable", when according to D1 (see column 2, line 65 to column , line 3) it should be appropriate to write that "the need to apply a tensioning force is obviated by the actuation of the lower tubular anchor".

4. According to the requirements of Rule 10.2 PCT, the terminology and the signs shall be consistent throughout the application. This requirement is not met in view of the use of the expressions shank and stud for the same feature: numeral 12 is used to identify a shank in page 4, line 6, but on page 5, numeral 12 is used instead to identify a stud, see lines 3, 4 and 7. for the same feature. Amended page 5 partially addresses this problem, as the term stud appears also in paragraphs 13, 17, 19, 21 and 22.

**Re Item VIII**

**Certain observations on the international application**

5.1 The present application contains 13 claims, of which claims 1 and 11 are independent. These claims are not in compliance with the provisions of conciseness of Article 6 PCT, as there is no clear distinction between them because of their overlapping scope.

5.2 The reasons are as follows: both independent claims relate to a rock bolt having an expandible tubular section for effecting a first anchoring action, to which is connected

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/ZA2004/000131

another section including a wedge member, for effecting a second anchoring action. It is deemed that the invention could be covered by one independent claim, with the further embodiments disclosed receiving coverage from the remaining dependent claims.

ROCK BOLTBACKGROUND OF THE INVENTION

[0001] This invention relates to a rock bolt.

5 [0002] A friction-type rock bolt relies on friction which is generated between at least part of the bolt and a surrounding surface of a hole in which the rock bolt is located, to be effective. The effectiveness of the anchor, provided by the rock bolt, depends on the frictional force which is generated by the interaction of the bolt with the surrounding rock mass and on the length of the rock bolt which extends into solid rock, beyond the rock which is being supported by the rock bolt.

10 [0003] A mechanically-anchored bolt makes use of an expansion unit, at one end of a shank, which is expanded into close contact with a surrounding wall of a hole in which the rock bolt is inserted. A washer is connected to an opposing end of the shank, with the washer bearing on an outer surface of a rock face in which the hole is formed. The effectiveness of this type of anchor is dependent, at least, on the 15 washer being in load-bearing contact with the rock face.

20 [0004] Although friction-type bolts are relatively easy to install they are susceptible to corrosion and, as noted, the effectiveness of this type of bolt depends on the frictional force which is generated. CH 564654 describes a two-stage device which makes use of two tubular anchors, which are expandable to provide friction support, wherein a shank which is connected to the anchors is recoverable.

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5

Over a substantial portion 40 of its length, see Figure 1, the tubular collar 18 has a constant cross section. The collar is tapered towards the end 32 so that it can be secured to the first end 14 of the stud by means of a swaging or similar process. In addition the collar is welded to the shank to ensure that these components are securely fixed to one another. At the same time the end 32 is sealed by welding.

5 [0022] The second end 16 of the shank 12 is threaded and is engaged in a threaded hole, not visible in Figure 2, which extends axially through a wedge- or conical-member 44 of the expansion unit 26. Three serrated shells 46 are positioned in tubular fashion around the wedge member and are connected to respective arms 48 of a bail 50. A coil spring 52 is positioned in an enclosure formed by the arms and extends between a base 54 of the bail and an opposing surface of the wedge member.

10 [0023] Lower ends 56 of the shells can be held together by means of a breakable tie, eg. of plastic or rubber, to ensure that the shells are retained in position during transport and storage.

15 [0024] The tubular collar 18 has a lower or second end 60 to which is attached the valve collar 21.

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[0025] The valve collar 21 is tubular in cross-section and has an inner diameter 62 which is just large enough to pass over the tubular collar 18, and a flared end 64 to prevent the bearing plate 20 from travelling past the valve collar. There is a hole 66 in the U-shaped outer portion 34 of the collar 18 to accept the valve 22.

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INT1138/MAJR/jes

1

CLAIMS

1. A rock bolt (10) which includes a tubular section (18) which is expandable to effect a first anchoring action and an expansion unit (26) which is expandable to effect a second anchoring action and which is connected to the tubular section, and which is characterized in that the expansion unit includes a wedge member (44), and a plurality of shells (46) which are movable by the wedge member to effect the second anchoring action.  
5
2. A rock bolt according to claim 1 wherein the tubular section (18) is an elongate tubular section which is radially expandable.
- 10 3. A rock bolt according to claim 1 or 2 which includes a valve (22) which is connected to the tubular section and through which a pressurized fluid can pass into an interior of the tubular section to expand the tubular section.
4. A rock bolt according to any one of claims 1 to 3 wherein the tubular section (18), in a non-expanded form, includes a generally U-shaped outer portion (34) and a smaller, generally U-shaped inner portion (36) which is positioned at least partly inside the outer portion.  
15
5. A rock bolt according to any one of claims 1 to 4 which includes a bearing plate (20) which is engaged with the tubular section (18) at a position at which the bearing plate abuts structure which serves to retain the bearing plate engaged with the tubular section.  
20
6. A rock bolt according to any one of claims 1 to 5 which includes a shank (12) which extends between the tubular section and the expansion unit.

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INT1138/MAJR/jes

2

7. A rock bolt according to claim 6 wherein the tubular section is swaged or welded onto the shank (12), or is threadedly engaged with the shank.
8. A rock bolt according to claim 6 or 7 wherein an end of the tubular section (18) at least partly encloses an end of the shank (12).
- 5 9. A rock bolt according to any one of claims 1 to 5 which includes a coupling device (104) which is secured to the tubular section (18), and a shank (12) which is threadedly engaged with the coupling device and to which is attached the expansion unit.
10. A rock bolt according to any one of claims 6 to 9 wherein the wedge member (44) is at one end of the shank (12), and the plurality of shells (46) abut an outer surface of the wedge member, and which includes a bail (50) which is connected to the shells and a biasing member (52) which acts between the bail and the wedge member.
15. A rock bolt (10) which includes an elongate tubular member (18) which is formed with an inlet (106) through which a pressurized fluid can pass, into an interior of the tubular member, thereby to expand the tubular member in a radial direction and so effect a first anchoring, an elongate shank (12) with a first end (14) which is secured to the tubular member and a second end (16), and an expansion unit (26) at the second end of the shank which is operable to effect a second anchoring action, and which is characterized in that the expansion unit includes a wedge-shaped member (44).
20. A rock bolt according to claim 11 wherein the first end (14) of the shank is directly secured to the tubular member (18).

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INT1138/MAJR/es

3

13. A rock bolt according to claim 11 which includes a coupling device (104) which is secured to the tubular member and the shank is indirectly secured to the tubular member by being detachably threadedly engaged with the coupling device.

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